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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/879,208	06/13/2001	Yukihito Oowaki	02887.0141-01000	4453
22852	7590	07/01/2004	EXAMINER	
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP 1300 I STREET, NW WASHINGTON, DC 20005			RAO, SHRINIVAS H	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 07/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/879,208

Applicant(s)

OOWAKI ET AL. *CK*

Examiner

Steven H. Rao

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 14-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 June 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Priority

Receipt is acknowledged of paper submitted under 35 U.S.C. 119(a)-(d), claiming priority from Japanese patent application no. 182899 filed on June 29, 1998 which papers have been placed of record in the file.

Request for Continued Examination Application (RCE)

The request filed on 9/8/2000 for a Continued Examination Application (RCE) under 37 CFR 1.114 (d) based on parent Application No. 09/302165 is acceptable and a RCE has been established. An action on the RCE follows.

Information Disclosure Statement

No further IDS has been submitted by the Applicants' after the one submitted on December 14, 2001.

Preliminary Amendment Status

Acknowledgment is made of entry of preliminary amendment filed April/19 /2004.

Therefore claims 14, 18, 22, and 27 as amended by the amendment and claims 15-17,19-21,23-26,28-33 as previously recited are currently pending in the Application.

Claims 1-13 and 34-39 have been cancelled.

Drawings

New corrected drawings are required in this application because all of the steps recited in the claims are not shown in the drawings.

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Claim 14 line 12 recites, "forming an insulator film on said impurity diffusion region ". The drawing figures e.g. 3 A to 3 E showing the first embodiment of the invention shows regions 2 as the impurity diffusion region and insulator film 3 specification page 12 etc., which is not formed on the impurity region but currently shown as being formed in the second trench . The drawing must show the insulator film formed on the impurity diffusion region or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the

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changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Similarly Applicants' must ensure that every feature of the invention specified in the claims 15-27 and 33 are also shown in the drawings.

Claim Objections

Claims 14, 18, 22, 27 are objected to because of the following informalities:

All of these claims recite, " forming a gate insulator film in said second groove with controlling a thickness of the gate insulator film" which is not clear.

If Applicants' mean " forming a gate insulator film in said second groove and controlling a thickness of the gate insulator film " , the same can be so recited.

Dependent claims 15-17, 19-21, 23-26, 28 to 31 and 33 are objected to at least for depending upon objected to claims.

. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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Claims 14 –31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shin (U.S. Patent No. 5,270,257, herein after Shin) previously applied and further in view of Wen (U.S. Patent No. 5,949,116, hereinafter Wen) newly applied.

With respect to claim 14, Shin describes a method for producing a MIS transistor comprising a semiconductor substrate, (Shin fig. 3a # 21, col.4 line 19) source/drain regions formed on the semiconductor substrate, (Shin figure 3 c # 26b,a, col. 4 lines 46-47) and a gate electrode provided above a channel region between the source/drain regions, (Shin fig. 3b # 24, col. 4 line 41 and region below gate 24 and oxide 23) said method comprising: selectively forming a first film on said semiconductor substrate, (Shin fig. 3 c-e # 22-nitride) etching said semiconductor substrate to form a first groove by using said first film as a mask; (Shin Figure 3A) forming a second film in said first groove (Shin fig. 3 b# 23/25) and thereafter removing said first film; (Shin fig. 3C) .

Shin does not specifically disclose the steps of forming an impurity diffusion region including a part of a bottom of the first groove (i.e. an impurity diffusion region) diffusing an impurity on a surface of said semiconductor substrate to form an impurity diffusion region including a part thereof extending below the first groove by using said second film as a mask; forming an insulator film on said impurity diffusion region and thereafter removing said second film to form a second groove in the semiconductor substrate.

However, Wen , a patent from the same filed of endeavor , describes in figures 2A to 3 and col. 2 lines 21-53 forming an impurity diffusion region including a part of a bottom of the first groove to form self-aligned source/drain regions in small channel

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length devices (figs. 2A to B and col. 2 lines 21-52, col.2 lines 44-46) to provide a process for fabricating a Mos device that allows a contact widow elsewhere than source/drain region thus resulting in smaller device .

Therefore it would have been obvious to one of ordinary skill in the art , at the time of the invention to include Wen's step of forming an impurity diffusion region including a part of a bottom of the first groove to form self-aligned source/drain regions in small channel length devices in Shin's method , the motivation to make the above combination is to provide a process for fabricating a Mos device that allows a contact widow elsewhere than source/drain region thus resulting in smaller device . (Wen col. 1 lines 49 to57).

The remaining limitation of claim 14 are :

and thereafter removing the second film to form a second groove on the semiconductor substrate (Figure 2C removal of 201,207) so that a top surface of the impurity diffusion region of the semiconductor substrate is higher than a bottom surface of the second groove; (figure 2C 200 above 209) forming a gate insulator film in said second groove with controlling a thickness of the gate insulator film so that a top surface of said gate insulator film is higher than a top surface of said impurity diffusion region' (interpreted to mean " and" instead of 'with" –see 112 objection above) and forming a gate electrode on the top surface of said gate insulator film. (Wen figure 2 D to F, gate insulator film 210, 211) .

With respect to claim 15, wherein the second film is semiconductor film (Shin film 24 is poly silicon , Shin col. 4 line 41) and forming a sacrificial film in the first

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groove before forming the second film in the first groove (Wen figs. 2 B and C) removing the sacrificial film after removing the second film to form the second groove. (Wen fig. 2B # 207 and Figure 2C).

With respect to claim 16, wherein a step of polishing a surface of the second film by using the first film as a stopper (Shin fig. 11, col. 6 lines 66-67).

With respect to claim 17, forming a protective film in the second groove before forming the gate insulator film in the second groove (Shin fig. 14 # 285).

With respect to claim 18, it repeats all the steps of claim 14 (see above) and further includes the step of : polishing the gate insulator film by using the insulator film as a stopper (Shin fig. 11, col. 6 lines 66-67).

Claims 19-21 repeat the steps of claims 15-17 and are rejected for reasons set forth above.

Claim 22 repeats the steps of claim 18 except for the absence of the second film-forming step and is rejected for reasons stated under claim 18 above.

Claims 23 wherein the source/ drain regions are elevated by an epitaxial growth technique before the diffusion step. (Shin fig. 3 e # 28a and b, col. 4 lines 65-68).

With respect to claim 24, wherein the a diffusing step is carried out before elevating the source/drain region by epitaxial growth. (See above claim 23 and further it is well settled that changing the order of performing the methods steps is prima facie obvious unless the change in the sequence of steps can be shown to produce unexpected results or is critical to the method).

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It is also noted that the specification contains no disclosure of either the critical nature of the claim sequence of steps or any unexpected results arising there from. Where patentability is said to be based upon particular chosen dimensions or upon variable recited in a claim, the Applicant must show the chosen sequence are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ 2d 1934, 1936 (Fed. Cir. 1990).

Claims 25-26 repeat the steps of claims 19 and 21 above and are rejected for reasons stated above.

With respect to claim 27, repeats the steps of claims 18 and 22 and is rejected for reasons set out above.

Claims 28-31 repeat the steps of claims 23, 24, 25 and 26 and are rejected for reasons set out above.

B. Claims 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shin (U.S. Patent No. 5,270,257, herein after Shin) previously applied in view of Wen (U.S. Patent No. 5,949,116, hereinafter Wen) as applied to claims 14-31 above and further in view of Lee (U.S. Patent No. 6,248,622, hereinafter Lee).

With respect to claim 32 , in addition to the steps of claims 18 and 22, claim 32 further recites the source/drain regions forming an inclined surface between the top surface of the semiconductor layers and the channel region (Shin fig. 3e # 26a and b) , forming a dummy film on the channel region that borders the semiconductor layers (part of 24 etched away).

Depositing a gate electrode on a top side of the gate insulator film to form a gate electrode having a cross section of a T shape.

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Wen describes the forming of a gate electrode on a top side of the gate insulator film to form a gate electrode . (Wen figs. 2f and 3).

Shin and Wen do not specifically describe the gate having a cross section of a T-shape .

However, Lee, a patent from the same filed of endeavor, describes in fig. 3 B-D and col. 5 lines 7-8 describes a metal layer and a damascene structure that has a T-shaped cross-section to form a circuit/device with improved speed and avoiding logical cross-talk errors.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include Lee's interconnect having a T-shaped cross section in Krivokapic method to form a circuit/device with improved speed and avoiding logical cross-talk errors. (Lee col. 1 lines 41-44).

Claims 33 repeat the steps of claims 14 and 22,23, 28 and are rejected for the reasons set out above.

Response to Arguments

Applicant's arguments with respect to claims 14-33 with regard to new limitations added by the preliminary amendment have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H. Rao whose telephone number is (703) 3065945. The examiner can normally be reached on 8.00 to 5.00.

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The fax phone numbers for the organization where this application or proceeding is assigned are (703) 7463926 for regular communications and (703) 872-9319 for After Final communications.

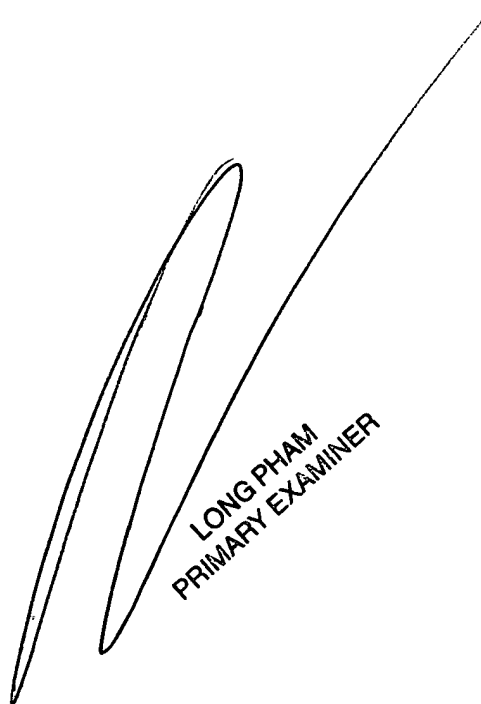
Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 3067722.



Steven H. Rao

Patent Examiner.

June 21, 2004.



LONG PHAM
PRIMARY EXAMINER